Sea Turtles of the Indo-Pacific

Research Management & Conservation

Edited by

Nicolas Pilcher & Ghazally Ismail

UNIVERSITI MALAYSIA
SARAWAK

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**SEA TURTLES OF THE INDO-PACIFIC:
RESEARCH, MANAGEMENT AND CONSERVATION
Proceedings of the Second ASEAN Symposium
and Workshop on Sea Turtle Biology and Conservation**

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Preface

Sometime in late 1998 we were in a meeting with Datuk Lamri Ali, the Director of Sabah Parks, discussing sea turtle conservation issues, the lack of data and information sharing among local and regional scientists and managers, and the need for a training workshop for some of the Park rangers. From this meeting blossomed the idea for the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, and from that point onward the event took on a life of its own. Adopting the theme "Beyond the beach", the meeting had among its main objectives to highlight the fact that turtle conservation should be seen as more than working simply on nesting beaches, and that the migratory movements, genetic research and broad scale, international collaboration was essential for protecting these migratory giants.

The Symposium, which was held from 15 to 17 July 1999, brought together nearly 150 local and international participants, including highly respected scientists, government representatives, the tourism sector, Park Rangers, and people who just cared about sea turtle. Never had we anticipated the keen interest that was shown by the international community, or the role the meeting was to play in further conservation activities. Over 40 presentations and several posters provided a wealth of information on current research, management and conservation issues that spanned the Indo-Pacific region, and from these we have endeavoured to produce this volume.

The book is now one of the most up-to-date sources of information on sea turtle projects in the region, and serves as a useful guide to literature which was previously unknown. The chapters contained herein are both informative and useful to scientists, managers, legislators, and for anyone who wants to learn more about sea turtles in the region, or in general. For example, Jeanette Wyneken warns of conservation practices that, though with good intentions, may not always be in the better interest of turtles: "commonly used management tools ... may `short-circuit' normal developmental events by depriving turtles of essential experiences". Jeanne Mortimer's work on movements of turtles using satellite telemetry in the Seychelles "confirms the need for regional cooperation to ensure effective management of hawksbill populations". The book lists in many cases the exact legislation that governs the use or protection of turtle, and provides a

fascinating and informative history of the use of Trawler Excluder Devices, or TEDs, and the recent WTO trade issues.

Section 1 on Management and Conservation contains papers that describe the conservation status and management approaches in a number of ASEAN and non-ASEAN nations. Section 2 on Nesting and Foraging Populations describes a number of sea turtle populations in the Indo-Pacific area. Section 3 follows the main theme of the conference, and highlights the fact that many conservation and management approaches are not necessarily beach-based, such as hatcheries and incubators. Section 4 covers research and management on turtle populations before they enter the sea as hatchlings, while Section 5 deals with ways in which we may help turtle populations. Finally, Section 6 discusses TEDs and the road ahead, a major issue in today's turtle conservation efforts, and particularly after the recent USA/Asia market disputes.

The overwhelming acceptance of what has become known as the Sabah Declaration, calling for the establishment of a broad agreement on cooperation, that expanded upon the existing ASEAN Memorandum of Understanding on Sea Turtle Conservation to encompass the Indian Ocean and Australia, was among the first steps in developing such an agreement. Since then, the first dialogue session on the development of such an agreement was hosted in Perth, Australia, in October 1999, and the second round of talks is scheduled for July 2000, to be hosted by Malaysia.

We are honoured to present here the work of some truly outstanding people.

Nicolas Pilcher
Ghazally Ismail
June 2000

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2nd ASEAN Symposium and Workshop on Sea Turtle Conservation and Biology

SABAH DECLARATION

REPRESENTATIVES, concerned scientists and participants from countries of the Indo-Pacific and Indian Ocean regions, including Southeast Asian member nations, having met at Kota Kinabalu, Sabah, Malaysia, from July 15-17 1999 to participate in the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation;

ACKNOWLEDGE that:

Six of the world's seven species of marine turtles inhabit the waters of the Indian Ocean and Indo-Pacific: The Leatherback (*Dermochelys coriacea*); Olive Ridley (*Lepidochelys olivacea*); Green Turtle (*Chelonia mydas*) Hawksbill (*Eretmochelys imbricata*); Loggerhead (*Caretta caretta*); and Flatback (*Natator depressus*);

Marine turtles of the Indo-Pacific and Indian Ocean region are a shared resource with cultural, ecological and economic value;

These turtles have a complex and migratory life history that is dependent on oceanic, coastal and terrestrial habitats;

Since the 1st ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation in 1993, governments from ASEAN member countries and other countries of the region have become increasingly aware of the challenges posed with respect to the conservation of marine turtles and have increased their efforts to address these challenges including the ASEAN Memorandum of Understanding on Sea Turtle Conservation and Protection, and the establishment of the Turtle Islands Heritage Protected Area (TIHPA);

Advances in scientific research on marine turtles and marine turtle populations have resulted in widespread awareness and scientific consensus on the fragile status of marine turtle populations and a growing recognition that the threats to those populations have increased as a result of several factors;

The long term survival and recovery of marine turtle populations of the Indian Ocean and Indo-Pacific region requires cooperation among all the countries throughout the migratory range of these populations;

Existing bilateral and multilateral instruments in the region include the Turtle Islands Heritage Protected Area, ASEAN Sea Turtle MOU, SPREP, and The Convention on the Conservation of Migratory Species of Wild Animals (CMS), and these expressly provide institutional frameworks for regional cooperation;

THEREFORE:

SUPPORT the negotiation and implementation of a wider regional agreement for the conservation and management of marine turtle populations and their habitats in the Indo-Pacific and Indian Ocean region, through which the countries of the region shall cooperate further to promote, advance and support national programs and regional cooperation;

RECOMMEND that the ASEAN member governments and other governments throughout the Indo-Pacific and Indian Ocean region support efforts to negotiate such an agreement and participate actively in negotiations and implementation toward that end;

CALLS upon relevant organisations including NGOs and multilateral institutions in the Indian Ocean and Indo-Pacific regions to support the negotiation, inclusive of actual engagement;

WELCOMES the proposal of the Government of Australia to organize a meeting of concerned countries on regional sea turtle management and conservation in October 1999,

And finally, ENDORSE this declaration and UNDERTAKE to provide ready support, in both their official and unofficial capacities, to help formulate and implement a regional agreement among the countries of the Indian Ocean and Indo-Pacific regions to further the conservation and management of the region's marine turtle populations.

2nd ASEAN Symposium and Workshop on Sea Turtle Conservation and Biology

RESOLUTION

Whereas the reefs and islands of the Spratly Archipelago host a considerable diversity of flora and fauna, among 2,500 km^2 of tropical seas,

Whereas unsustainable resource exploitation has been a serious problem in the Southeast Asian region, and

Whereas the Spratly Archipelago supplies fishery resources for thousands of people,

The participants of the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, including specialists and experts from claimants to the islands and reefs, recognise the urgent need to develop adequate measures to ensure the conservation and sustainable management of the marine resources and habitats, and recommend to claimant nations to:

- Enable further collaboration among claimants and opportunities for discussing issues relating to marine biodiversity, organisms and environment;
- Facilitate and encourage information exchange regarding marine biodiversity, particularly sea turtles; and
- More opportunities for discussing issues related to marine biodiversity of the "Freedom Islands" through regional forums.

2nd ASEAN Symposium and Workshop on Sea Turtle Conservation and Biology

RESOLUTION

Representatives, concerned scientists and participants from countries of the Indo-Pacific and Indian Ocean regions, including Southeast Asian member nations, having met at Kota Kinabalu, Sabah, Malaysia, from 15-17 July 1999 to participate in the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation;

Record their appreciation to the Government of India and the State of Orissa for their efforts made to contain Olive ridley mortality and the return of ridleys to the Gahirmantha Coast;

While appreciating the initiation of the national Sea Turtle Programme of India, the Workshop urges the authorities of the GOI and State of Orissa to safeguard the new nesting sites in Orissa resulting out of changing coastal geomorphologic processes.

The workshop further urges rapid enforcement of existing coastal fishing regulations to curtail near-shore mechanised fishing and to accelerate the development of a TED programme in India.

2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation

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SECTION 1

Management and Conservation

1 The Sea Turtle Harvest in the Kai Islands, Indonesia

Alexis Suárez

Abstract

Six species of sea turtles inhabit the rich waters, coral reefs, and seagrass beds of the Kai Islands, located in the southeastern Moluccas, Indonesia. Hard-shelled turtles are hunted for sustenance, traditional feasts, and to generate extra income for those who sell their shell, meat and eggs. Leatherbacks have been traditionally hunted in Kai for sustenance and ritual purposes for many generations (Suárez and Starbird 1996). Sea turtles are captured with harpoons, treble hooks, and incidentally drown in gill and shark nets throughout the archipelago (pers. obs.).

Locals report that sea turtle populations have declined dramatically in recent decades, most likely due to many generations of harvest. This intensive take of turtles in Kai may be due to the lack of forest resources, such as bird, deer and pig, and an increasing population of residents in the region. Data presented are based on evidence of turtle nesting and/or foraging; observations of the capture of turtles or evidence of their capture; turtle mortality data collected by fishermen; and interviews of village chiefs, elders and fishermen from Ohoidertutu, Ohoidertom, Ohoiren, Somlain, Matwaer, Ur, Tanimbar Kai and Warbal villages.

Introduction

The Kai Islands are located between New Guinea and Australia, in the Maluku Province of Indonesia (5°43'S; 132°50'E). A diversity of marine life inhabits this archipelago which includes six species of sea turtles: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Olive ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*), and flatback *(Natator depressus)* turtles. Leatherbacks (*Dermochelys coriacea*) frequent the waters southwest of Kai Kecil Island to feed on jellyfish which are seasonally found in large numbers in this area.

The study area encompassed eight villages, five of which are located on Kai Kecil Island (Ohoidertutu, Ohoidertom, Ohoiren, Somlain and Matwaer), and three which are located on adjacent islands (Ur, Tanimbar Kai and Warbal)

(Fig. 1). Population size in these villages ranges from 50 to 850, and the area is inhabited by a total population of approximately 4,000 inhabitants. Kai residents subsist primarily on marine resources and agriculture, and fish and marine turtles are the main sources of protein throughout the year.

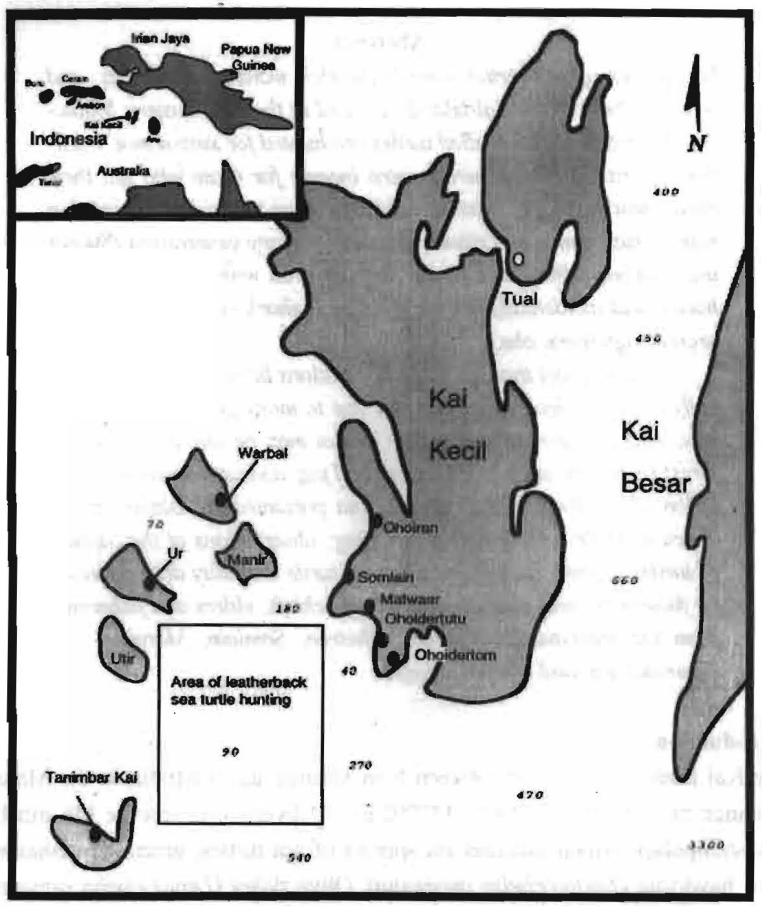

Fig. 1: Location of traditional leatherback fishery in the Kai Islands, Indonesia. Depths are in metres. Map is not to scale.

The objectives were to gather information on the traditional leatherback fishery and the distribution, abundance and use of other sea turtle species in Kai waters (including the sale of sea turtle products). In collaboration with Pro-

gramme Lingkunkan Maluku, this project conducted the following activities from October 1994 to February 1995: observed leatherback hunts at sea; conducted interviews of village chiefs, elders, fishermen and others throughout Kai; and visited vendors, warehouses, and breeding operations of hawksbills in the islands, and in Tual and Ambon, nearby ports and city-centres.

Methods

Rituals, locations, methods and traditional beliefs associated with the traditional leatherback hunt were documented and the hunt was photographed (see Suárez and Starbird 1996). Fishermen, elders, village chiefs, teachers, and others from Kai communities were asked about the local distribution, ecology and use of sea turtles; leatherback capture numbers, season, locations, methods, and traditional beliefs associated with the hunt. Interviews were conducted using a standardised questionnaire, and a species identification leaflet with photos of each species. To learn about the sale of hawksbill shell in the area, questions regarding this subject were included in interviews. Information learned from interviews led to visits to shell vendors, breeding operations, and a warehouse full of hawksbill scutes illegally available for sale.

Any sea turtles or sea turtle habitats, such as seagrass beds and coral reefs, encountered while travelling throughout the islands were noted. Fishing camps on Warbal and Ur Islands were visited to interview fishermen and look for evidence of turtles captured in this area. Any evidence of turtle harvest throughout the archipelago was noted. Fishermen and village chiefs from eight villages were trained in sea turtle data collection techniques and hired to collect data (e.g., species, measurements, method of capture, fate of the shell/meat) for turtles taken in their villages for a six month period.

Results

The traditional leatherback hunt – Leatherback turtles, locally known as *Tabob*, have been hunted (Fig. 2) in the Kai islands for approximately seven generations in Ohoidertutu (P. Teniwut, Ohoidertutu, pers. com.). Leatherbacks are easily accessible to fishermen in the Kai Islands during October to January, when large numbers congregated in offshore waters to feed on large aggregations of jellyfish. Most leatherback hunting occurs in the Kai Islands during this time, and some hunting occurs in February and March if sea conditions permit. Eight villages on Kai Kecil and adjacent islands of Ur, Warbal and Tanimbar Kai

(Ohoidertutu, Ohoidertom, Matwaer, Ur, Warbal, Ohoiren, Tanimbar Kai, and Somlain) are the only villages in Maluku which hold the rights to hunt leatherbacks in this area.

Fig. 2: A leatherback hunted at sea by Ohoidertutu villagers, Kai Kecil, Indonesia.

Traditional beliefs and rituals, known as *adat*, are associated with the hunt. *Adat* is equated with the will of the ancestors and requires villagers to hunt for ritual and subsistence purposes. *Adat* prohibits the trade or sale of leatherback meat and it is local belief that a violation of *adat* may incur the wrath of ancestral spirits. Prior to the hunt, a village chief or elder makes offerings to deity and ancestors in a private, traditional ceremony. These offerings include a 100 Rupiah coin, rice liquor, lime, areca palm nuts and tobacco. Eight to ten men then sail a large dugout to an area 5-10 km from the western shores of Kai Kecil. Chanting is believed to attract a leatherback to the boat and occurs throughout the hunt until a turtle is sighted. In a chant hunters express their respect for the leatherback and their need for meat. Once a leatherback is sighted, the sails are dropped and all men on board row towards it. A man on the bow harpoons the turtle through the carapace or neck with a detachable spear tip (Fig. 3). When the turtle tires from struggling, it is pulled to the boat with a rope and clubbed on the head. Several men jump must then jump in the water to push the turtle over the gunnel of the boat.

Fig 3: A leatherback captured with several harpoons in the Kai Islands.

A hunting boat from Ohoidertutu was observed capturing a leatherback in as little as one hour from the time it left the village (Suárez, pers. obs.). As many

as 13 leatherbacks have been taken by this village in one day (P. Teniwut, Ohoidertutu village chief, pers. comm. 1995). It is estimated that approximately 100 leatherbacks can be taken in one season by the villages in Kai, depending on other village activities. The villages of Ohoidertutu, Warbal and Tanimbar Kai are the most active hunting villages among the villages in Kai. Ohoidertutu takes 60-70 % of the total number of leatherbacks. This village, established in 1800, has several strong boats and hunting cooperatives. It is also situated in a windy location in the islands, and local fishermen have strong and seasoned sailing and hunting skills. Warbal, Ur, and Tanimbar Kai combined take 30-40 % of the captured leatherbacks, but because they are near coral reef areas, they tend to rely more on hard-shelled turtle species and fish. The villages of Ohoiren and Matwaer are small and have few hunting boats. Somlain village relies much less upon sea turtles for meat because they have poultry coops and over 60 % of their men live in Irian Jaya to work in the mines.

During this study, 65 leatherbacks were captured in Kai, of which 61 were harpooned and four were incidentally captured in nets. The average curved carapace length was 147cm (range 136-173). The leatherbacks which accidentally landed in nets were discarded, as they were caught by Muslim fishermen who do not eat turtle meat, and *adat* prohibits the trade or sale of leatherback meat.

The utilisation of sea turtles in Kai – Six species of sea turtles inhabit Kai waters, and all except the flatback have the following local names: *Keran* for the hawksbill turtle; *Fen babar* for the loggerhead; *Fen mafurit* for the green; and *Fen marcel* for the Olive ridley turtle. Sea turtles inhabiting Kai waters are captured with harpoons, nets, and treble hooks, and on the beach while nesting. Their nests are also poached. Evidence of sea turtle harvest was seen throughout the archipelago. Economic pressures to support families make turtles and their eggs a prime target for coastal residents since they are easy to obtain, harmless and fetch a good price. The commercial value of turtle products in the market exposes them to exploitation, especially during the recent economic crisis in Asia. In addition, the human population in Kai has increased in recent decades, and will likely continue to increase in coming decades. For example, Ohoidertutu village today has a total population of 833 residents, 300 of whom are under the age of 12.

Hard-shelled sea turtles (Cheloniidae) are utilised as a means of sustenance, for traditional feasts, and to generate extra income for those who hunt and sell their meat, shell and eggs in Tual, the commercial center on Kai Kecil (Fig. 4). Treble hooks are used to capture turtles in the shoulder or leg with its triple hook. Turtles are also incidentally captured in shark and gill nets set throughout the islands, and especially around the villages of Ohoidertutu, Ur, Ohoiren and Warbal. Hawksbill and green turtles comprise the majority of the take, and are captured with nets and treble hooks near the islands of Ur, Warbal, Utir, Noohoe Taa, Lea Tengwaer, and Tanimbar Kai and near the villages of Somlain, Ohoidertom, and Ohoidertutu on Kai Kecil Island.

Fig. 4: Children of Somlain village await the butchering of a turtle.

During this study, the green turtle was the species most frequently taken in Kai. In a six month period, 173 greens were captured (57 % in nets, 39 % by

treble hook and 4 % while nesting). Two tags were recovered from Australian and Malaysian green turtles killed in Kai waters. The green turtle from Malaysia was tagged twenty five years ago. Eighty-seven hawksbills were taken (60 % in nets, 39 % by treble hooks and one was harpooned near a reef). Three Olive ridleys were taken in waters near Kai Kecil Island. A female was captured using a treble hook, and the fishermen reported the turtle swam towards him and was easy to capture. The other two were males, one was captured in nets near Warbal Island and the other by harpoon during a leatherback hunt. No data was collected on these animals or on the two flatback turtles taken by a fishermen on Ur Island.

After many generations of intensive harvest, Kai residents report sea turtle numbers have declined in recent decades. Other marine animals in Kai, such as dugongs and giant clams, have experienced a similar fate and are now very rare. The intensity of the turtle harvest may be due to a number of reasons, including: (i) the loss of forest resources in southwestern Kai Kecil and a greater dependence on marine resources; (ii) an increasing Kai population; and (iii) an increase in the number of nets now available and used in this area.

Hawksbill sale – In 1995, hawksbills were still captured in Kai and their products sold throughout Maluku and Indonesia. All hawksbills encountered in Kai are captured for meat and the majority of carapaces from the larger animals are sold. Most of the hawksbills are taken from the southern Kai Islands, as they are reported to be more rare in northern Kai. Hawksbill shell has been an important cash crop in Kai, especially during 1970 to 1990, when villages in Kai made substantial amounts of money from the hawksbill trade. Village Chiefs in Kai claim to have sold thousands of kilograms of shell to buyers in Jakarta, Tual, Ambon and Sulawesi.

Live turtles and their meat were still sold in markets in 1995, and hawksbill jewelry and stuffed hawksbills were sold widely throughout Indonesia, at various airports and in many downtown stores in Ambon, Jakarta, Tual, and Sulawesi. Profit made from the hawksbill trade is not evenly distributed among all those who contribute to their capture and sale, and local villagers appear to make the least profit from any final sale.

From interviews we learned of a local warehouse in Kai where hundreds of kilograms of hawksbill scutes were stored. We visited this warehouse as well as a village in northern Kai where 41 hawksbills with the white scutes, considered more expensive, were kept in captivity for breeding (Fig. 5). We also in-

terviewed and visited a hawksbill shell buyer/seller and a craftsman in Tual who made jewelry from shells and stuffed turtles for sale to tourists. In his shop were shells as small as ~30cm, as well as many other marine specimens from local fauna, such as dugong tusks to be made into cigarette holders. Several other stores which sold hawksbill products were visited in Tual and Ambon.

Fig. 5: A hawksbill sea turtle in a breeding operation in Kai Kecil Island.

Conclusions

Six species of sea turtles inhabit the waters of the Kai archipelago and are often killed whenever encountered. All of those interviewed throughout the islands reported that local sea turtle abundance has declined in recent decades. This exploitation is likely to affect turtle populations of nearby islands, such as Irian Jaya, Tayandu and Aru, and neighbouring nations, such as Malaysia and Australia (as evidenced by tag recoveries). Also, one can assume the various flatback carapaces which were seen in a fishing camp on Ur Island are from Australia.

With the endangered status of leatherbacks in mind, it is of concern that today some traditional *adat* beliefs associated with leatherback hunting in Kai no longer exist. Elders report that today leatherbacks are hunted more frequently and in greater numbers than in past decades. This shift in attitudes is especially present among younger generations who hunt without as much regard for tradition, and this was also documented during the observation of hunts at sea (pers. obs.). This is especially concerning because it is local belief that *adat* will keep leatherback populations from declining or becoming extinct.

The leatherback turtles which forage in Kai waters are likely to come from a nearby nesting site, such as the north coast of Irian Jaya, some 1000 km away by sea (Bhaskar, 1985). The current status of this nesting population is in question, as it has been subjected to intensive nest loss for many years from predation by wild pigs, poaching and erosion. Two other leatherback populations have shown recent dramatic declines, the nearby Terengganu, Malaysia population and the Pacific population of leatherbacks in Mexico (Chan and Liew 1996, Sarti and Eckert 1996). The many current threats to leatherbacks in the Indo-Pacific, and these recently documented declines, imply a greater need for the conservation of any remaining leatherbacks in the Pacific.

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2 Status and Conservation of Sea Turtles in Orissa, India

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Abstract

Orissa is a maritime state located on the eastern coast of Indian peninsula, and is rich in natural resources. The marine turtles are represented by four species belonging to the families Cheloniidae and Dermochelidae. Results of a continuing study from 1976 to 1999 by the Wildlife Wing of Forest Department indicate that there are three important mass nesting grounds of the Olive ridley sea turtle, Lepidochelys olivacea, *at the mouths of rivers Dhamra, Devi and Rushikulya. Sporadic nesting in also takes place at other locations. The rookery at Gahirmatha (Dhamra river mouth) is considered one of the largest mass nesting grounds for Olive ridleys throughout their range. The nesting beach is a protected area which forms part of the Bhitarkanika Wildlife Sanctuary and National Park. The nearshore breeding area was also given protected area status by the State Government in 1997 and is known as the Gahirmatha (Marine) Wildlife Sanctuary. This paper outlines the present status of marine turtles and their habitats in Orissa, and highlights conservation measures in place and emerging threats, and suggests additional steps needed for turtle protection and management.*

Introduction

Orissa is one of the maritime states of India, located between 17°49'N; 81°27'E and 22°34'N; 87°29'E, and bounded by the Bay of Bengal on the east (Fig. 1). It has a coastline of about 480 km from the West Bengal border (the river Subarnarekha) to the Andhra Pradesh border (the river Bahuda). The region comprises seven major river deltas of varied sizes and shapes formed by the rivers Subarnarekha, Budhabalanga, Baitarani, Bramhani, Mahanadi Rushikulya and Bahuda. The sandspits and islands at the river mouths are favourable nesting grounds for marine turtles. Based on physiographical characteristics, the state has five major morphological regions: the

gions: the coastal plains, the middle mountainous and highlands region, the central plateaus, the western rolling uplands and major flood plains. It is one of the richest biodiversity regions in Southeast Asia in general and India in particular. The reptilian fauna includes 110 species belonging to 21 families (Mishra et al. 1996) which include four species of marine turtles.

Up to the early 1970s, data on sea turtles that visited Orissa remained limited. The occurrence and abundance of Olive ridley sea turtles in Gahirmatha was only known to the inhabitants of Kanika Raj, and to the local administration of Kanika and the Forest Department of Orissa (Kar 1988, Dash & Kar 1990, Chadha & Kar 1999). The existence of the large rookery became known to the scientific community only in the early 1970s (FAO 1974, Bustard 1976). Thereafter, the endangered status of sea turtles led to a number of research activities and now there is considerable data on turtle nesting in Orissa (Bustard & Kar 1981, Dani & Kar 1999; Dash & Kar 1987, Kar 1980a,b, 1981, 1982, 1988, 1999a,b,c, Kar & Bhaskar 1982; Kar & Dash 1984a,b, 1985, Kar et al. 1997, 1998, Kar & Padhi 1992, Kar & Satpathy 1996, Mishra et al. 1996, Mohanty-Hejmadi 1993, 1996, 1999, Mohanty-Hejmadi & Sahoo 1994, Pandav et al. 1994a,b, 1995, 1996a,b, 1997, Whitaker & Kar 1984). Unfortunately, knowledge on the offshore activities of adult turtles, and migratory patterns and activities of hatchlings after they leave the coast is still poor. A survey of the Orissa coast in the 1970s records coastal waters of Puri-Balukhand as the most-important turtle fishing centre of the state (Biswas 1982). Considerable amount of egg exploitation used to occur at Gahirmatha, to be shipped to Calcutta. Adult turtles, illegally captured, were also shipped to Calcutta. Today there is no commercial exploitation due to stringent actions taken by State and Central Governments since 1975. However, new threats have emerged since the mid 1980s, such as incidental catch / intentional killing due to fishing-related activities. Both State and Central Government are concerned about this mortality and various steps are now being taken to curtail and minimise their impact.

Of the six species of sea turtles found in the Indo-Pacific region, five species are found in India. Of these, four are reported to occur in the coastal waters of Orissa. These are the Leatherback (*Dermochelys coriacea)*, Green (*Chelonia mydas)*, Hawksbill *(Eretmochelys imbricata)* and the Olive ridley *(Lepidochelys olivacea*), of which the Olive ridley is the most common. All

turtles are legally protected in India under Schedule I of the Wildlife (Protection) Act, 1972 (Amended 1991). India is a signatory to CITES and the Convention on Migratory Species (CMS), and the trade of sea turtles is prohibited through these international agreements. Unauthorised capture or harassment of sea turtles or taking their eggs or disturbing their nests is prohibited and can carry fines which shall not be less than Rupees Five Thousand and imprisonment for a term which shall not be less than one year but may extend to six years. The main constraint however, is lack of proper enforcement of the law, mainly due to lack of requisite infrastructure, manpower, equipment and resources.

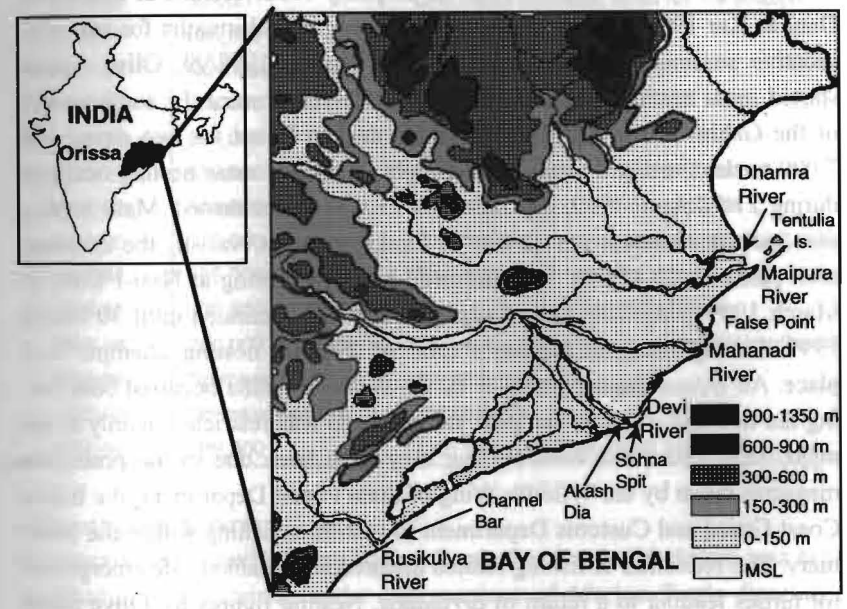

Fig. 1: Location map and physiographic features of the Orissa coast.

Results of a continuing study from 1976 to 1999 by the Wildlife Wing of the State Forest Department indicated that there are three major mass nesting (*arribada*) beaches for Olive ridleys in Orissa, at Gahirmatha, the Devi River mouth, and the Rushikulya river mouth. There are also minor nesting grounds at the sandspits of all river mouths and islands, and sporadic nesting takes place along the entire Orissa coastline. More than half a mil-

lion Olive ridley turtles nest on these three rookeries every year. Congregations of sea turtles and mass breeding occurs in the coastal waters in front of the three nesting sites. The migrating turtles arrive and congregate in the shallow coastal waters of Orissa in October, and most hatchlings emerge by May. This period coincides with the main fishing season, when turtles become vulnerable to fishing activities.

Gahirmatha

The rookery at Gahirmatha is the largest nesting ground and the Gahirmatha coastal waters are the largest breeding ground for Olive ridleys in the world (Kar 1988, Dash & Kar 1990, Kar & Satpathy 1996, Chadha & Kar 1999, Dani & Kar 1999). There was no mass nesting at Gahirmatha for two consecutive seasons (1996/97 and 1997-98). During 1998/99, Olive ridleys started mass nesting on March 12 1999 at Pentha, toward the southern end of the Gahirmatha coast. The first mass nesting lasted for two days, with 7,000 turtles nesting during day and night. A second mass nesting occurred during 21-22 April 1999, during which 28,000 turtles nested. Mass nesting also took occurred at two places in Ekakulanasi: at Nasi-II, the *arribada* took place on 23 March 1999 followed by mass nesting at Nasi-I from 25 March 1999. The mass nestings at Nasi I and II continued until 30 March 1999. During these *arribadas*, a total of 298,000 nesting attempts took place. An unique feature was that the *arribada* at Pentha occurred both during the day and night. In the past, the *arribada* was restricted mainly to the night time. The latest mass nesting may have been due to the protection measures taken by the Wildlife Wing of State Forest Department, the Indian Coast Guard and Customs Department to minimise fishing within the Sanctuary. The reduction of fishing related disturbances enabled safe emergences for turtles leading to a return of *arribadas*. Nesting figures for Olive ridley turtles at Gahirmatha coast are presented in Table I.

Some of the threats to sea turtles and their habitats in Orissa are:

- Loss and modification of nesting habitats due to coastal developmental activities,
- Artificial lighting and increased illumination around nesting beaches,
- Incidental capture in fishing nets,
- Large-scale vessel movements in congregated breeding zones,

- Large scale conversion of traditional crafts into mechanised boats,
- Wide use of gill nets, and
- Changes in the land and sea use patterns in the vicinity of nesting beaches.

Table I: Estimated number of Olive ridley Sea Turtles, Lepidochelys olivacea *nesting at Gahirmatha Coast, Orissa from 1984/85 to 1998/99.*

Nesting season	*Nesting emergences*	*Remarks*
1984-85	292,000	One major, one minor and two mini arribada
1985-86	50,000	One major arribada, small for the season
1986-87	636,000	Two major arribadas
1987-88	No mass nesting	No arribada
1988-89	318,000	One major arribada
1989-90	207,000	One major arribada
1990-91	659,000	One major and one minor arribada
1991-92	384,000	One major and one minor arribada
1992-93	672,000	One major,one minor and one mini arribada
1993-94	695,000	Two major and one mini arribada
1994-95	339,500	One major and one mini arribada
1995-96	290,000	One major, one minor and two mini arribadas
1996-97	No mass nesting	No arribada
1997-98	No mass nesting	No arribada
1998-99	298,000	One major and two minor arribadas

Conservation Efforts

In January 1997, the Northern Indian Ocean Sea Turtle Workshop was held in Bhubaneswar, Orissa, under the auspices of Marine Turtle Specialist Group of IUCN, CMS, NOAA, the Forest Department of the Government of Orissa and Utkal University. Representatives from nine Northern Indian Ocean countries and other international experts discussed the status of sea turtle conservation and management in the Northern Indian Ocean and drafted a Marine Turtle Conservation Strategy and Action Plan for the Northern Indian Ocean. As a follow up action, the Ministry of Environment and Forests, Government of India, has come forward to support the management of sea turtles and their habitats through a variety of centrally spon-

sored schemes such as development of National Parks and Sanctuaries, eco-development in and around Protected Areas and the GEF-assisted eco-development to Parks and Sanctuaries.

Realising the global concern for sea turtles and for the urgent need to take immediate action to conserve the marine turtles of this region, the Central Government launched 'Project Turtle' along the Orissa coast in particular and the Indian coast in general with funding support from UNDP/GEF. This project derives its legislative support from the Government of India's National Biodiversity Action Plan, the Wildlife Action Plan and also the Action Plan for Conservation of mangrove forests, coral reefs, and wetlands. The primary objective of the project is to conserve globally significant marine turtle populations through a participatory approach. The Marine Turtle Conservation Project aims to devise and facilitate the implementation of sustainable marine turtle conservation strategies through education, extension, research and community participation. The main objectives of the project are to curtail the mass mortality of Olive ridley sea turtles along the Indian coast in general and Orissa coast in particular, the identification and protection of critical sea turtle habitats, the use of Turtle Exclusion Devices, effective enforcement to regulate fishing and trawling, and simultaneous implementation of eco-development plans through participatory approach by local communities. Other objectives include survey and evaluation of nesting sites and nesting seasons, breeding and feeding areas, regulation of fishing by trawlers and gill netters, control of beach erosion, control the damage by predators, control poaching of eggs from nesting beaches as well as poaching of adults from offshore coastal waters.

The Ministry of Environment and Forests provides assistance to a number of National Parks and Sanctuaries for Wildlife Conservation and their development under the centrally sponsored schemes of development, which include conservation of marine turtles at the Bhitarkanika Wildlife Sanctuary, the Bhitarkanika National Park, and the Gahirmatha (Marine) Wildlife Sanctuary.

An expert committee was established in 1984 by the Ministry of Environment and Forests to look into various aspects of turtle conservation in the country and to suggest various methods and means for their protection.

Specific measures undertaken up by the State Government of Orissa

In the last two decades, various steps have been taken by the Wildlife Wing of Forest Department of Government of Orissa, including:

- Banning the large-scale collection of eggs in 1975 through the implementation of the Wildlife (Protection) Act, 1972.
- Awarding Protected Area status from Dhamra Muhan to Barunei, Gahirmatha on 22 April 1975.
- Effectively protection at Gahirmatha mass nesting beaches since 1975/76.
- Including local people in data collection and conservation efforts since 1975/76.
- Trade of adults through Passenger/Express trains was stopped in 1975/76.
- Trade of adults through goods trains was stopped in 1977/78.
- Trade of adults (as fishery products) stopped was since in the 1980s.
- Increased vigilance in the early 1980s stopped the illegal trade of adults through roadways.
- From 1977/78 to 1982/83 poaching of adults in the high seas was curved through the involvement of the Navy, Coast Guard and other law enforcement agencies through 'Operation Geeturt'.
- Public awareness campaign started via media services involving NGOs such as WWF.
- 20 km offshore Gahirmatha coastal waters declared as a 'No Fishing Zone' in 1993.
- 20 km offshore from Jatadhar Muhan to Devi river mouth, and Chilika river mouth to Rushikulya mouth declared as a 'No Fishing Zone' in 1996/97.
- The Northern Indian Ocean Sea Turtle Workshop held at Bhubaneswar in 1997 that resulted in the 'Orissa Declaration' and drafting of the 'Marine Turtle Conservation and Action Plan for the Northern Indian Ocean'.
- High Power Committees set up under the Chairmanship of Chief Minister, Orissa in 1996.
- The Gahirmatha Marine (Wildlife) Sanctuary was declared in 1997.

- Aerial Surveys, as well as onshore/offshore patrolling strengthened by Coast Guard during 1998/99 through 'Operation Olive'.
- 'Operation Kachhapa' was jointly initiated in 1998/99 by the Wildlife Wing of Orissa Forest Department, through tha Wildlife Protection Society of India with the cooperation of local conservation groups.
- Demonstrations of Turtle Exclusion Devices were carried out at Paradeep and Dhamra involving the Trawler Owners Associations, Fisheries Department and local conservation groups.
- Awareness programmes were launched involving local people, especially the fishing communities, and bringing together local conservation groups and all law enforcement agencies of the State and Central Governments.

Existing acts and rules for protection of sea turtles and their habitats in Orissa

- The Wildlife (Protection) Act, 1972 (Amended, 1991).
- The Wildlife (Protection) (Orissa) Rules, 1974.
- The Central Water Pollution Act, 1974.
- The Central Water Pollution (Amendment) Act, 1978.
- The Environmental (Protection) Act, 1986
- Coastal Regulation Zones (CRZ I, II & III).
- The Orissa Marine Fishing Regulation Act, 1982.
- The Orissa Marine Fishing Regulation Rules, 1983.
- Coastal Zone Illumination (Prevention & Control) Act, and Rules (Proposed).

Further action needed to conserve marine turtles

Habitat Protection – Designation of additional conservation areas with intense sea turtle activity, such as Devi and Rushikulya rookeries, along with adjacent breeding grounds. Artificial lighting near major sea turtle nesting beaches and breeding grounds need to be stopped.

Basic Protection Measures – Offshore patrolling is needed to check the near shore mechanised fishery to minimise incidental capture. Public awareness

and education programmes should be developed to involve the local communities in sea turtle conservation programs.

Management Oriented Research – Regular monitoring of important sea turtle nesting beaches as well as offshore and aerial surveys to establish population size trends. Satellite telemetry and tagging programs to study the distribution of sea turtles and other related biological aspects. Determining the impact of offshore fishing operations and coastal developmental activities on marine turtles.

Conclusions

The population of Olive ridley sea turtles in Orissa represents about 80 percent of Indian sea turtles and about 50 percent of the world population. Therefore, protection, conservation research and management of this globally important population should be high on priority list in India and the Southeast Asian region. International and regional agreements may be initiated to develop meaningful strategies and to develop suitable regional and National action plans for the protection, conservation, research and management of sea turtles. This endangered species and its critical eco-fragile habitats can be protected if donor agencies and international funding agencies come forward and provide required inputs on a priority basis as a follow up action to the Rio Declaration, the conservation and action plan for the Northern Indian Ocean, better known as the Orissa Declaration, different international conventions (CITES, CMS) and regional treaties (SAARC, ASEAN).

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3 Artificial Lighting and the Recovery of Sea Turtles

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Abstract

Florida serves as an important developmental habitat for sea turtles, and hosts the second largest loggerhead rookery in the world. This paper reviews the historical decline of sea turtles in Florida, U.S.A., and the recent evidence that suggests a modest recovery. ASEAN countries and Florida have in common that they are experiencing rapid coastal development. In Florida artificial lighting from coastal communities is an important source of hatchling mortality, and probably constricts the location of major nesting sites to the few remaining dark beaches. ASEAN countries can plan now to avoid these problems by developing national light management plans. Central to such a plan is protection of the present major rookeries ('core areas'). At these sites, lighting should be entirely excluded not only from the beach, but also from areas behind the beach in the form of a buffer (no development) zone. Such areas should be established as preserves, perhaps supported by ecotourism. The facility at the Malaysian Turtle Islands Park in Sabah can serve as a good model. Smaller rookeries located near existing coastal communities can be protected by well-established light management techniques. By planning now, ASEAN countries can avoid Florida's mistakes, which necessitate expensive and labour-intensive efforts to protect rookeries. They will also be in a better position to both protect and sustain their sea turtle resources for future generations.

Introduction

ASEAN continental and island nations are custodians of some of the richest marine and terrestrial biological communities known to mankind. In many instances they also must exploit those same resources to provide the material wealth necessary to improve the lives of their people. The problem, as always, is to determine what levels of exploitation can be sustained while still preserving each country's biological heritage. Increasingly these days, ecologists and conservation biologists tell us that exponential human population growth must be